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Bulk-Material Supercontinuum Generation for Temporal Compression of Ultrafast Laser Pulses

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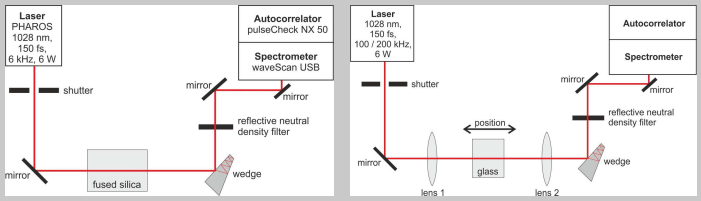
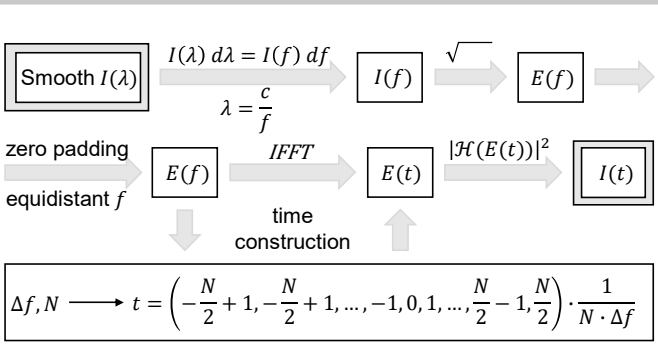
Introduction

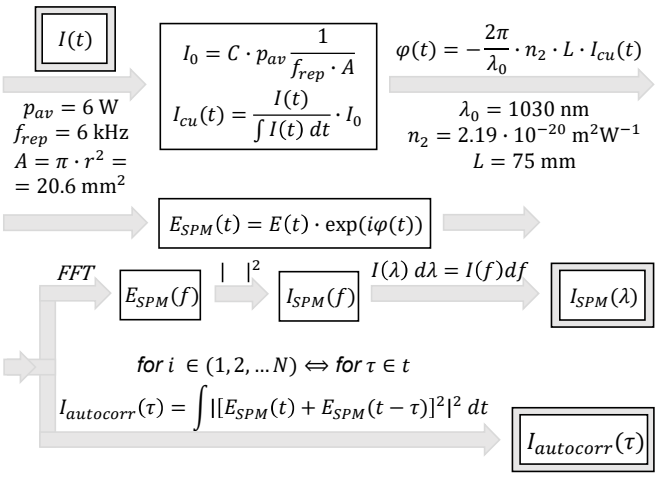
For the generation of ultrashort laser pulses spectral broadening of the output of commercially available short-pulse laser sources is essential. This can be achieved by nonlinear light - matter interaction. Here we studied self-phase modulation of a commercial Yb:KGW laser system (PHAROS from Light Conversion) in fused silica. In a first step, the spectrum and the interferometric autocorrelation of the unfocused laser beam, propagating through fused silica, were measured and analysed in contrast to measurements without fused silica in the beam path. The obtained spectra were compared to numerical simulations of self-phase modulation with the experimental laser parameters as well as the Fourier transform of the initial spectrum as input. Although dispersion was neglected in the computations, the results and the experimental observations are in excellent agreement. In a second step, limits of self-phase modulation were explored by increasing beam intensities using a focused laser beam. The spectra and further the interferometric autocorrelations of the broadened pulses were measured. At the limit of self-phase modulation, even a white light supercontinuum was observed. Based on these measurements, it could be possible to achieve a 50% reduction of the pulse duration, if proper dispersion compensation can be implemented.

Experimental Setup



Simulations





Results